

# **METHOD FOR PRODUCING FRAUD-PROOF VALUE PAPER, AND VALUE PAPER PRODUCED BY SAID METHOD**

## **Field of the Invention**

The invention relates to a method for producing a fraud-proof value paper having improved protection characteristics.

## **Prior Art**

A method for producing fraud-proof value paper is known in the art, according to which a thread is applied to the wire of the cylinder of a paper-making machine and subsequently paper pulp layers are formed in a bath, pressed and dewatered by drying (see, RU, C1, 2125938).

A disadvantage of the above method is insufficient quality of protection against fraud due to a low area of thread coming to the paper surface.

## **Summary of the Invention**

This invention is based on the objective to provide a method for producing value paper, which would ensure a larger area of a thread coming to the paper surface, and provide value paper that would ensure improved identification of its protection and, thus, to improve the quality of protection of said value paper against fraud.

The stated objective is achieved in the first embodiment of the inventive method by that in the known method for producing fraud-proof value paper, which includes application of a thread onto the wire of the cylinder of a paper-making machine, dewatering of the paper pulp layers formed in the bath and their pressing, according to this invention the said thread is a thread made of an elastic shaped plastic provided with protective elements, and annular continuous and/or intermittent slots having sloped walls being made over the length of a wire cylinder prior to applying the thread thereon, and the slot bottom widths being made commensurate to the thread core width, and at applying the thread it being brought into

contact with a slot prior to the time of wire contacting with paper pulp in a bath, while ensuring tight fit of the thread core at the slot bottoms in order to eliminate its filtering ability and fix the thread core on the paper surface, raise wings upwards due to the slot sloped walls, and fix the wings in the paper stock by dewatering during the formation and pressing stages.

Thus, in the result, value paper is produced wherein the thread is made of an elastic shaped plastic provided with protective elements, and wings of the said thread are fixed in the paper stock.

The stated objective is achieved in the second embodiment of the inventive method by that in the known method for producing fraud-proof value paper, which includes application of a thread onto the wire of the cylinder of a paper-making machine, dewatering of the paper pulp layers formed in the bath and their pressing, according to this invention the said thread is a thread made of an elastic shaped plastic provided with protective elements, and annular continuous and/or intermittent slots having sloped walls being made over the length of a wire cylinder prior to applying the thread thereon, and the slot bottom widths being made commensurate to the thread core width, and at applying the thread it being brought into contact with a slot after the time of wire contacting with paper pulp in a bath and into paper pulp, while ensuring formation of the primary paper stock layer on the wire surface and the slot, fitting the thread core at the bottom layer and inside the paper stock, raising wings upwards due to the slot sloped walls, and fixing the wings in the paper surface by dewatering during the formation and pressing stages in order to achieve the anti-Xerox effect, the said wings being fixed by thermoplastic adhesion between the thread coating and the paper fiber.

Thus, in the result, value paper is produced wherein the thread is made of an elastic shaped plastic provided with protective elements, and wings of the said thread are fixed on the paper surface.

The stated objective is achieved in the third embodiment of the inventive method by that in the known method for producing fraud-proof value paper, which includes application of a thread onto the wire of the cylinder of a paper-making machine, dewatering of the paper pulp layers formed in the bath and their pressing, according to this invention the said thread is a thread in the form of an endless tape made of a metallized plastic and having the core provided with a surface adhesion coating and lateral elements in the form of wings having an adhesive coating, which are disposed symmetrically and/or asymmetrically relative to the

longitudinal axis of the core and placed at a regular and/or irregular spacing, wherein the core carries protective information that may be visually checkable or machine-readable, the core being fixed on the paper surface, and the wings being fixed in the paper stock due to dewatering at the formation and pressing stages.

Thus, in the result, value paper is produced wherein the thread is made of a metallized plastic and the core carries protective information that may be visually checkable or machine-readable wherein the core is disposed on the paper surface, and wings of the said thread are fixed in the paper stock.

The stated objective is achieved in the fourth embodiment of the inventive method by that in the known method for producing fraud-proof value paper, which includes application of a thread onto the wire of the cylinder of a paper-making machine, dewatering of the paper pulp layers formed in the bath and their pressing, according to this invention the said thread is a thread in the form of an endless tape made of a metallized plastic and having the core provided with a surface adhesion coating and lateral elements in the form of wings having an adhesive coating, which are disposed symmetrically and/or asymmetrically relative to the longitudinal axis of the core and placed at a regular and/or irregular spacing, wherein the core carries protective information that may be visually checkable or machine-readable, the core being fixed in the paper sheet, and the wings being fixed on the paper sheet surface due to dewatering at the formation and pressing stages in order to achieve the anti-Xerox protective effect.

Thus, in the result, value paper is produced wherein the thread is made of a metallized plastic and the core carries protective information that may be visually checkable or machine-readable, wherein the core is disposed in the paper stock, and wings of the said thread are fixed on the paper surface.

The above advantages and the specific features of this invention will be further disclosed in the description of the preferred embodiments, as taken with the appended drawings.

#### Brief Description of the Drawings

FIG. 1 shows the slot arrangement on the wire cylinder, as intended for implementing the inventive method according to the first and second embodiments.

FIG. 2 shows the form of the slots shown in FIG. 1.

FIG. 3 schematically shows a wire cylinder with a bath, a lateral view, intended for implementing the inventive method according to the first embodiment.

FIG. 4 shows the formation of wings on the thread.

FIG. 5 shows a cross-section of paper produced in accordance with the first embodiment of the inventive method.

FIG. 6 shows another arrangement of a wire cylinder with a bath for implementing the inventive method in accordance with the second embodiment.

FIG. 7 shows a cross-section of paper produced in accordance with the second embodiment of the inventive method.

FIG. 8 shows the thread configuration for the third and fourth embodiments of the inventive method.

FIG. 9 shows a position of the thread on a paper carrier for the third and fourth embodiments of the inventive method.

FIG. 10 shows a cross-section of paper produced in accordance with the third embodiment of the inventive method.

FIG. 11 shows a cross-section of paper produced in accordance with the fourth embodiment of the inventive method.

#### Description of Preferred Embodiments

For all the embodiments the inventive method (FIG. 3, 6) for producing fraud-proof value paper includes the stage of applying the thread 1 onto the wire 2 of the wire cylinder 3 of a paper-making machine and the subsequent stages of dewatering, when forming layers from the paper pulp 4 in the bath 5, and pressing and subsequent drying.

In the first and the second embodiments of the inventive method a thread made of an elastic shaped plastic and provided with protective elements (not shown), e.g., holograms, cinegrams, optically variable systems, is used as the thread 1.

Annular, continuous and/or intermittent slots 6, having sloped walls, are made along the entire length of the wire cylinder 3 before applying the thread 1 onto the wire.

The width of the bottom 7 of the slots 6 is made commensurate to the width of the core of the thread 1 (FIG. 4).

According to the first embodiment, when applying the thread 1 its contact with the slot 6 is effected prior to the time of contact 8 between the wire and the paper pulp 4 in the bath 5 (FIG. 3), and the core 9 of the thread 1 is tightly fit at the bottoms 7 of the slots 6 (FIG. 4) for the purpose of eliminating its filtering ability, thus fixing the core 9 (FIG. 5) on the paper surface.

At the places of disposing the core of the thread 1 the latter comes to the paper sheet surface. If deepened gaps in the wire are made in the path of the slots 6, where the thread 1 is isolated from the wire surface, then in such places the thread 1 will remain in the paper stock, being covered by paper layers on two sides.

Due to the sloped walls of the slots 6 (FIG. 2, 4) the wings 10 of the thread 1 are raised upwards and then, under the influence of the formed layers of the paper stock 4 and in the process of paper sheet compaction during pressing, they remain in the paper sheet having thickness  $h$  (FIG. 5) and perform the function of holding elements, as "foundation bolts". The thread 1 is fixed on the sheet due to its adhesion outer coating that mechanically contacts the paper sheet fiber.

The thread 1 is securely held on the paper sheet surface due to, primarily, the wings 10 (FIG. 5) that also have double-sided adhesion coating. An advantage of such a thread 1 is that the area of the thread, which comes to the surface, is significantly larger, which enables to saturate it with complex protective elements having good visual checkability.

According to the second embodiment (FIG. 6), when applying the thread 1 in the form of a thread made of an elastic shaped plastic provided with protective elements, e.g., microtexts, symbols, bar codes formed by de-metallization and sealed with luminescent dyes, the thread is brought into contact with the slot 6 after the contact 11 is achieved between the wire with the paper stock in the bath 5 and into the paper stock 4, the primary paper layer is formed on the wire surface and on the slot 6 (FIG. 2) and the core 9 is disposed on the layer at the bottom 7 and inside the paper, forming the wings 10 (FIG. 7).

In order to ease reading the drawings and understanding the essence of the inventive method embodiments, on FIG. 3 and 6 reference number 12 indicated the water level, reference number 13 indicates inflow of the stock, reference number 14 indicates overflow.

The thread 1 with the wings 10 (FIG. 6, 7) comes into contact with the bottom 7 of the annular slot after the wire contacts the paper stock, i.e., comes into the paper stock. At that, the pulp primary layer is formed on the wire surface, including the surface of the annular slot 6, i.e., paper layers begin to form.

The thread 1 is placed on layers in the slot 6, and the core 9 is disposed inside the paper sheet (FIG. 7) having thickness  $h$ . Due to the sloped walls of the slot 6 that is not yet filled with the paper stock completely, the wings 10 are raised and come to the paper surface, and when a paper sheet is formed on the cylinder 3 (FIG. 6) and pressed the wings 10 coming to the surface (FIG. 7) create the anti-Xerox effect and are held on the sheet surface due to the thermoplastic adhesion between the thread coating and the fiber. An advantage of such a thread 1 is that the area of the wings 10, which come to the surface, is significantly larger, which enables to saturate the thread with complex protective elements having good visual checkability.

The third and the fourth embodiments of the inventive method for producing fraud-proof value paper also include applying the thread 1 onto the wire of the cylinder 3 of a paper-making machine and subsequent stages of dewatering, when layers of the paper stock 4 are formed in the bath 5, pressing and drying (FIG. 3, 6).

A thread in the form of an endless tape made of a metallized plastic may be used as the thread 1. The said metallized plastic tape is made of two layers of equal or not equal thickness, which are glued together, one of them having metallization on the glued side, or a mono-thread having one-side metallization may be used.

The thread 1, in contrast to the first and the second embodiments, has the central core 15 with an adhesive coating having the thickness preferably from 2 to 5 mm and the lateral elements in the form of the wings 16 with an adhesive coating having the length preferably from 3 to 5 mm, the said wings being disposed symmetrically and/or asymmetrically relative to the longitudinal axis of the core 15 and placed at a regular and/or irregular spacing. The core 15 carries protective information, e.g., holograms, changing-color elements, elements

that are visible or invisible at different angles of view, de-metallization elements visible in transmitted light, a luminescent coating or a local sealing.

According to the third embodiment of the inventive method, the core 15 is fixed on the surface of the paper 17, and the wings 16 are fixed due to dewatering at the stages of forming and pressing in the middle of the thickness  $h$  of the paper 17 (FIG. 10).

According to the fourth embodiment of the inventive method, the core 15 of the thread 1 is fixed in the paper sheet having the thickness  $h$ , and the wings 16 are fixed due to dewatering at the stages of forming and pressing in the middle on the surface of the paper 17 for the purpose of creating the anti-Xerox protective effect (FIG. 11).

In order to implement the inventive method according to the third embodiment, the core 15 and the wings 16 of the thread 1 have a surface adhesion coating creating good adhesion of the protective thread 1 with paper fibers, which exceeds the adhesive force of fibers inside paper. The wings 16 act as “foundation bolts” holding the “installation strap” on the surface.

The bases of the wings 16, due to partial (from 0.5 to 1.0 mm) coming to the surface of the paper 17 (FIG. 10), create a special effect that is difficult to counterfeit. In general, it is impossible to falsify such a bulky thread without special equipment and special technologies.

Furthermore, a non-traditional form of the thread, which is visible in transmitted light, renders additional protective functions to the article.

According to the fourth embodiment of the inventive method, the core 15, being completely disposed in the paper sheet having the thickness  $h$  (FIG. 11) may carry a wide variety of both visible and machine-readable protective elements, in particular de-metallization elements visible in transmitted light, where, due to application of luminophors of various colors to different sides of the adhesive coating, when acting with ultraviolet light on transparent elements, a mixed color will be visible, e.g., on one side the thread 1 will glow yellow and on the other one – blue, then on elements transparent due to de-metallization green light will be visible. Elements carrying a magnetic material and elements detected under X-ray irradiation, etc. may be also used.

#### Industrial Applicability

The embodiments of the inventive method for producing fraud-proof value paper may be most successfully used for commercial production of various types of securities.